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Amendments to the Claims

Listing of Claims:

1. (Cancelled) A computer-implemented method of validating a document structured as an ordered tree having labeled elements, known to conform to varying element types in accordance with a first schema, with respect to a second schema, said method comprising:

preprocessing the first and second schemas to identify subsumed type-pairs, of the form type1-type2 where type1 is a type defined in the first schema and type2 is a type defined in the second schema, the pairs indicating that an element's content that conforms to the first type, type1, will also conform to the second type, type2; and

identifying subsumed element tag-type-pairs, of the form tag-type1-type2, where tag is an element name, type1 is a type in the first schema and type2 is a type in the second schema; it indicates that if the specified element tag appears in a document conforming to the first schema with content of type1, then this element tag can validly appear in a document conforming to the second schema and its content will conform to type type2.

2. (Canceled) The method of claim 1 wherein the step of preprocessing comprises comparing said first schema and said second schema to determine relationships between said first schema and said second schema.

3. (Canceled) The method of claim 2 wherein the step of preprocessing comprises determining relationships between types defined in said first schema and said second schema.

4. (Canceled) The method of claim 3 wherein a type defined in said second schema is identified as a subsumed type if a relationship exists between a type in said first schema and said type in said second schema such that portions of a document that are valid with respect to said type in said first schema are also valid with respect to said type in said second schema.

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5. (Canceled) The method of claim 3 wherein a type defined in said second schema is identified as a disjointed type with respect to a type in said first schema if a relationship exists between said type in said first schema and said type in said second schema such that portions of a document that are valid with respect to said type in said first schema are not valid with respect to said type in said second schema.
6. (Canceled) The method of claim 3 wherein a type defined in said second schema is identified as an intersecting type if a relationship exists between a type in said first schema and said type in said second schema such that some portions of a document that are valid with respect to said type in said first schema are valid with respect to said type in said second schema and some portions of a document that are valid with respect to said type in said first schema are invalid with respect to said type in said second schema.
7. (Canceled) The method of claim 3 wherein said relationships between said types defined in said first schema and said second schema are used to determine whether said document is valid or invalid in said second schema.
8. (Canceled) The method of claim 5 wherein a document is determined to be invalid with respect to said second schema if said document contains types that are identified as disjointed.
9. (Canceled) The method of claim 4 wherein any portions of a document that are of a subsumed type are immediately accepted as valid with respect to said second schema.
10. (Canceled) The method of claim 3 wherein types assigned to document elements while validating with respect to said first schema are used to validate the document with respect to said second schema.
11. (Canceled) The method of claim 10 wherein said types assigned to said document elements

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while validating with respect to said first schema are provided with said document.

12. (Canceled) The method of claim 10 wherein said types assigned to the document elements during validation with respect to said first schema are computed while validating said document with respect to said second schema.

13. (Canceled) The method of claim 10 wherein a document is deemed invalid if a type assigned to a document element during validation with respect to said first schema is in a disjoint relationship with a type in said second schema.

14. (Canceled) The method of claim 10 wherein a document element is deemed valid if said document element is assigned a type during validation with respect to said first schema that is in a subsumed type relationship with a type in said second schema.

15. (Canceled) The method of claim 10 wherein said computed information and said assignment of types when said document is validated with respect to said first schema are used to determine portions of said document that are to be validated according to said second schema.

16. (Canceled) The method of claim 15 wherein a portion of said document is validated according to said second schema if said type assigned to said portion of said document during validation with respect to said first schema is in an intersecting relationship with a type in said second schema.

17. (Canceled) The method of claim 16 wherein the preprocessing comprises developing an automaton from a first type in said first schema and a second type in said second schema that are in an intersecting relationship to determine if a portion of said document that is assigned said first type during validation with respect to said first schema is valid with respect to said second type during validation with respect to said second schema.

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18. (Canceled) The method of claim 1 wherein said first schema and said second schema are one of a regular expression, document type definition, finite state automata, XML schema and tree automata.

19. (Canceled) The method of claim 1 wherein said document is an XML document.

20. (Canceled) The method of claim 3 wherein said types are one of states in a finite state automaton, element type declarations in an XML schema, programming language types and states in a tree automaton.

21. (Canceled) The method of claim 1 comprising examining said document and determining if any portions of said document have been modified subsequent to said document being validated in said first schema and limiting portions of the document to be validated based upon which portions of said document have been modified.

22. (Canceled) The method of claim 21 comprising identifying elements of said document that have been inserted and examining any elements that have been inserted to determine if they are valid with respect to said second schema.

23. (Canceled) The method of claim 21 comprising identifying elements of said document that have been renamed and using a determined relationship between said renamed elements and said element prior to being renamed when validating said renamed elements with respect to said second schema.

24. (Canceled) The method of claim 21 comprising identifying elements of said document that have been deleted and ignoring any deleted elements when validating said document with respect to said second schema.

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25. (Canceled) The method of claim 21 wherein the information computed comprises a set of modification specifications such that a modification specified by said set of modification specifications results in the document being valid according to said second schema.

26. (Canceled) The method of claim 21 wherein the information computed comprises a set of modification specifications such that a modification specified by said set of modification specifications results in a document being invalid according to said second schema.

27. (Canceled) The method of claim 1 wherein said document has been modified subsequent to being validated in said first schema and wherein said first schema is the same as said second schema.

28. (Canceled) An information handling system for validating a document structured as an ordered tree having labeled elements, known to conform to varying element types in accordance with a first schema, with respect to a second schema; said information handling system comprising:

a processor configured for:

preprocessing the first and second schemas to identify subsumed type-pairs, of the form type1-type2 where type1 is a type defined in the first schema and type2 is a type defined in the second schema, the pairs indicating that an element's content that conforms to the first type, type1, will also conform to the second type, type2; and

identifying subsumed element tag-type-pairs, of the form tag-type1-type2, where tag is an element name, type1 is a type in the first schema and type2 is a type in the second schema; it indicates that if the specified element tag appears in a document conforming to the first schema with content of type1, then this element tag can validly appear in a document conforming to the second schema and its content will conform to type type2.

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29. (Canceled) A computer-readable medium comprising computer code for executing a method of determining whether a document conforming to a first schema may be cast in a second schema without validating every element of said document in accordance with said second schema, the document being structured as an ordered tree having labeled elements, known to conform to varying element types in accordance with a first schema, with respect to a second schema, said method comprising:

preprocessing the first and second schemas to identify subsumed type-pairs, of the form type1-type2 where type1 is a type defined in the first schema and type2 is a type defined in the second schema, the pairs indicating that an element's content that conforms to the first type, type1, will also conform to the second type, type2; and

identifying subsumed element tag-type-pairs, of the form tag-type1-type2, where tag is an element name, type1 is a type in the first schema and type2 is a type in the second schema; it indicates that if the specified element tag appears in a document conforming to the first schema with content of type1, then this element tag can validly appear in a document conforming to the second schema and its content will conform to type type2.

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30. (New) A computer-implemented method for determining compliance between a source document structured in accordance with a source schema and a target schema, the method comprising steps of:

receiving a source schema description and a target schema description;

receiving the source document, wherein the source document comprises an ordered tree structure with labeled elements;

identifying all corresponding element types in the source and target schemas for grouping the corresponding element types into element type pairs, wherein the element type is an indication of the content of an element, and wherein the element type further comprises an element tag name for XML schema if the source schema is XML schema;

classifying each element type pair, according to their relationship, into one of a group consisting of: matching, disjointed, and intersecting;

confirming compliance status of the source document, wherein the compliance status is compliant if it is determined that all element type pairs corresponding to root elements of the source document are classified as matching; and the compliance status is non-compliant if it is determined that at least one element type pair corresponding to a root element of the source document is classified as disjointed.

31. (New) The method of claim 30 further comprising steps of:

if it is determined that at least one element type pair corresponding to the root element is classified as intersecting, performing steps of:

identifying a subtree of the source document beginning with a topmost element of the source document, the subtree corresponding to the at least one element type pair classified as intersecting;

classifying the topmost element type pair into one of a group consisting of: matching, disjointed, and intersecting;

confirming compliance of the source document if it is determined that the topmost element type pair are classified as matching; and

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confirming non-compliance of the source document if it is determined that the topmost element type pair are classified as disjointed.

32. (New) The method of claim 31 further comprising steps of:

if it is determined that the topmost element type pair are classified as intersecting, performing steps of:

identifying a current child element pair of the topmost element type pair from the subtree, wherein the current child element pair comprises an element type pair from the source schema and an element type pair from the target schema;

classifying the current child element pair into one of a group consisting of: matching, disjointed, and intersecting;

confirming non-compliance of the source document if the current child element pair is classified as disjointed;

processing a next child element pair from the subtree if the current child element pair is classified as matching, wherein the processing step further comprises comparing element pairs; and

identifying the next child element pair from the subtree as the topmost element pair if the next child element pair does not belong to a same parent node as the current child element pair.

33. (New) The method of claim 30 wherein the matching classification comprises a relationship between the element type pair such that portions of the source document that are in compliance with respect to the element type in the source schema are also valid with respect to the corresponding element type in the target schema.

34. (New) The method of claim 30 wherein the disjointed classification comprises a relationship between the element type pair such that portions of the source document that are in compliance with respect to the element type in the source schema are not in compliance with respect to the corresponding element type in the target schema.

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35. (New) The method of claim 30 wherein the intersecting classification comprises a relationship between the element type pair such that some portions of the source document that are in compliance with respect to the element type in the source schema are in compliance with respect to the corresponding element type in the target schema and some portions of the source document that are in compliance with respect to the element type in the source schema are not in compliance with respect to the corresponding element type in the target schema.

36. (New) The method of claim 32 wherein the source document is determined to be non compliant with respect to the target schema if said source document contains child element pairs that are identified as disjointed.

37. (New) The method of claim 32 further comprising a step of:

developing an automaton from the child element pair determined to be intersecting to determine if a portion of the source document corresponding to the subtree is in compliance with the target schema.

38. (New) The method of claim 30 wherein the source schema and the target schema are one of a group consisting of: a regular expression, a document type definition, a finite state automata, an XML schema and a tree automata.

39. (New) The method of claim 30 wherein the source document is an XML document.

40. (New) The method of claim 30 wherein the element types are one of a group consisting of: states in a finite state automaton, element type declarations in an XML schema, programming language types and states in a tree automaton.

41. (New) The method of claim 30 further comprising a step of:

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examining the source document for determining if any portions of the source document have been modified subsequent to the source document being determined to be in compliance and limiting the portions of the source document to be validated to those portions of the source document that have been modified.

42. (New) The method of claim 41 further comprising a step of:

identifying elements of the source document that have been inserted subsequent to the source document being determined to be in compliance and immediately confirming compliance of those inserted elements.

43. (New) The method of claim 41 further comprising a step of:

identifying elements of the source document that have been deleted subsequent to the source document being determined to be in compliance and ignoring the deleted elements when processing said source document to determine compliance with the target schema.

44. (New) The method of claim 30 further comprising:

confirming compliance of the source document with respect to one of either the source schema or target schema when the source schema has been modified such that it is the same as the target schema.

45. (New) The method of claim 32 wherein the identifying, classifying, confirming, processing and identifying steps are performed recursively until the current child element pair is classified as disjointed and then the source document is immediately determined to be non-compliant.

46. (New) The method of claim 45 wherein the processing step is performed sequentially.

47. (New) The method of claim 45 wherein the processing step is performed in parallel.

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48. (New) The method of claim 45 wherein the processing step is performed as a combination of parallel and sequential processing.

49. (New) The method of claim 30 wherein determining compliance comprises ascertaining that the source document can be recast into the target schema without causing any loss of data.

50. (New) The method of claim 30 wherein the step of receiving the schema descriptions further comprises creating the schema descriptions.

51. (New) The method of claim 30 wherein the step of receiving the schema descriptions further comprises retrieving the schema descriptions from data storage.

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52. (New) An information processing system for determining compliance between a source document structured in accordance with a source schema and a target schema, the system comprising:

data storage for storing a source schema description, a target schema description, and the source document, wherein the source document comprises an ordered tree structure with labeled elements;

an input/output subsystem for communicating with a user of the information processing system regarding compliance status of the source document with respect to the target schema;

at least one processor configured to:

receive the source document and the source and target schemas;

confirm the compliance status of the source document according to an element type pair classification;

wherein the processor is operatively connected to a memory, the memory comprising logic for performing the following functions:

identifying all corresponding element types in the source and target schemas for grouping the corresponding element types into element type pairs, wherein the element type is an indication of the content of an element, and wherein the element type further comprises an element tag name for XML schema if the source schema is XML schema; and

classifying each element type pair, according to their relationship, into one of a group consisting of: matching, disjointed, and intersecting.

53. (New) The system of claim 52 further comprising an automaton for classifying each element type pair.

54. (New) The system of claim 52 wherein the processor is further configured to create the source schema description and the target schema description.

55. (New) The system of claim 52 wherein the memory further comprises separate locations for

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matching, disjointed, and intersecting element types.

56. (New) The system of claim 52 further comprising an internet connection for receiving, viewing, and storing documents over the web.

57. (New) A computer readable medium comprising software instructions for enabling a processor to:

receive a source schema description and a target schema description;

receive the source document, wherein the source document comprises an ordered tree structure with labeled elements;

identify all corresponding element types in the source and target schemas for grouping the corresponding element types into element type pairs, wherein the element type is an indication of the content of an element, and wherein the element type further comprises an element tag name for XML schema if the source schema is XML schema;

classify each element type pair, according to their relationship, into one of a group consisting of: matching, disjointed, and intersecting;

confirm compliance of the source document if it is determined that all element type pairs corresponding to root elements of the source document are classified as matching; and

confirm non-compliance of the source document according to the target schema if it is determined that at least one element type pair corresponding to a root element of the source document is classified as disjointed.